

AMENDMENTS TO THE CLAIMS

The following listing of claims replaces all prior listings, and all prior versions, of claims in the application.

LISTING OF CLAIMS:

1. (Currently Amended) A pattern defect inspection apparatus comprising:
a recipe setting unit for setting an inspection recipe and/or a review recipe;
an illumination optical system including:

a laser light source for emitting ultraviolet laser light;

a shutter for selectively restricting passage of the ultraviolet laser light emitted from the laser light source;

a quantity-of-light adjusting unit for adjusting a quantity of the ultraviolet laser light emitted from the laser light source in accordance with the inspection recipe and/or the review recipe set by the recipe setting unit;

an illumination range forming unit for forming on a sample an illumination range of the ultraviolet laser light whose quantity has been adjusted by the quantity-of-light adjusting unit;

a coherence reducing system for reducing coherence of the ultraviolet laser light received within the illumination range that has been formed by the illumination range forming unit; and

an irradiation optical system for irradiating the sample with a ultraviolet light flux whose coherence has been reduced by the coherence reducing system; and

a detection optical system including:

a condensing optical system for condensing light reflected from the sample;

a diffracted-light control optical system for controlling diffracted light of the reflected light that has been condensed by the condensing optical system; and

a detecting unit for imaging a reflected light image coming from the sample to detect an image signal, said reflected light image being obtained through the diffracted-light control optical system.

2. (Currently Amended) A pattern defect inspection apparatus comprising:
a recipe setting unit for setting an inspection recipe and/or a review recipe;
a quantity-of-light calculating unit for calculating a quantity of ultraviolet laser light in accordance with the inspection recipe and/or the review recipe that have been set by the recipe setting unit;

an illumination optical system including:

a laser light source for emitting ultraviolet laser light;
a shutter for selectively restricting passage of the ultraviolet laser light emitted from the laser light source;

a quantity-of-light adjusting unit for adjusting the quantity of the ultraviolet laser light, which has been emitted from the laser light source, to the quantity of light calculated by the quantity-of-light calculating unit;

an illumination range forming unit for forming in a sample an illumination range of the ultraviolet laser light whose quantity has been adjusted by the quantity-of-light adjusting unit;

a coherence reducing system for reducing coherence of the ultraviolet laser light received within the illumination range that has been formed by the illumination range forming unit; and

an irradiation optical system for irradiating the sample with a ultraviolet light flux whose coherence has been reduced by the coherence reducing system; and

a detection optical system including:

a condensing optical system for condensing light reflected from the sample;
a diffracted-light control optical system for controlling diffracted light of the reflected light that has been condensed by the condensing optical system; and
a detecting unit for imaging a reflected light image coming from the sample to detect an image signal, said reflected light image being obtained through the diffracted-light control optical system.

3. (Original) A pattern defect inspection apparatus according to claim 1, further comprising:

an image processing unit for detecting a defect of a pattern formed on the sample on the basis of the detection image signal detected by a detector provided in the detecting unit.

4. (Original) A pattern defect inspection apparatus according to claim 1, wherein said recipe setting unit has a recipe setting screen.

5. (Currently Amended) A pattern defect inspection apparatus according to claim 1, wherein said ~~quantity-of-light adjusting unit has an optical element capable of controlling shutter controls~~ the ultraviolet laser light emitted from the laser light source so that the ultraviolet laser light is switched between a state close to ON and a state close to OFF.

6. (Currently Amended) A pattern defect inspection apparatus according to claim 1, wherein:

~~said quantity-of-light adjusting unit has an optical element capable of controlling~~shutter controls the ultraviolet laser light emitted from the laser light source so that the ultraviolet laser light is switched between a state close to ON and a state close to OFF; and

~~said optical element~~shutter can arbitrarily control a period of time during which the ultraviolet laser light is in a state close to OFF.

7. (Original) A pattern defect inspection apparatus according to claim 1, wherein said quantity-of-light adjusting unit has a filter capable of changing the quantity of transmitted light.

8. (Original) A pattern defect inspection apparatus according to claim 7, wherein said filter is devised not to return light reflected from an incident plane to the laser light source.

9. (Original) A pattern defect inspection apparatus according to claim 1, wherein:

said detecting unit of the detection optical system comprises a first detector for detecting an image signal for inspection and a second detector for detecting an image signal for viewing, each of said first detector and said second detector being imaged a reflected light image obtained from the sample through the diffracted-light control system by switching a switching optical system between at the time of the inspection and the viewing.

10. (Original) A pattern defect inspection apparatus according to claim 1, wherein said first detector comprises an accumulated type image sensor.

11. (Original) A pattern defect inspection apparatus according to claim 3, wherein said image processing unit comprises:

a storage unit for storing a digital reference image signal;

a brightness correcting unit for correcting brightness of at least one of the digital image signals so that brightness in a normal portion of the digital detection image signal, which has been detected by the first detector and then converted into the digital signal, becomes substantially the same as brightness of a normal portion of the digital reference image signal stored in the storage unit; and

a defect detecting unit for detecting a defect of a pattern formed on the sample by comparing the digital detection image signal corrected by the brightness correcting unit with the digital reference image signal.

12. (Original) A pattern defect inspection apparatus according to claim 3, wherein said image processing unit comprises:

a storage unit for storing a digital reference image signal;

a scatter-diagram creation unit for creating a scatter diagram illustrating an association between a feature index in a normal portion of the digital detection image signal and a feature index in a normal portion of the digital reference image signal stored in the storage unit, said digital detection image signal being detected by the first detector and then being converted into a digital signal;

a local gray-scale converter for correcting a local gray scale value of at least one of the digital image signals on the basis of the scatter diagram created by the scatter-diagram creation unit; and

a defect detecting unit for detecting a defect of a pattern formed on the sample by comparing the digital detection image signal corrected by the local gray-scale converter with the digital reference image signal.

13. (Original) A pattern defect inspection apparatus according to claim 1, wherein said diffracted-light control optical system comprises a polarization element group.

14. (Currently Amended) A pattern defect inspection apparatus comprising:

a laser light source for emitting laser light;

a shutter for selectively restricting passage of the ultraviolet laser light emitted from the laser light source;

an illumination optical system for reducing coherence of the laser light emitted from the laser light source before irradiating a sample with the laser light;

a detection optical system for detecting an image of the sample irradiated by the illumination optical system; and

an image processing unit for handling the image of the sample detected by the detection optical system;

wherein said inspection apparatus handles a wafer having a diameter of 300 mm at a speed equivalent to a throughput of three pieces of wafers or more per hour, and detects a defect having a size of 100 nm included in a pattern formed on the sample.

15. (Currently Amended) A pattern defect inspection method comprising:
a recipe setting step for setting an inspection recipe and/or a review recipe;
an illumination step comprising the sub-steps of:

opening a shutter to allow passage of ultraviolet laser light emitted from a
laser light source;

adjusting by quantity-of-light adjusting unit a quantity of ultraviolet laser light
emitted from a laser light source in accordance with the inspection recipe and/or the
review recipe set by the recipe setting step;

forming by illumination range forming unit an illumination range of the
adjusted ultraviolet laser light in a sample;

reducing by coherence reducing system coherence of the ultraviolet laser
light received within the formed illumination range; and

irradiating by an irradiation optical system the sample with the ultraviolet light
flux whose coherence has been reduced; and

a detection step comprising the sub-steps of:

condensing reflected light coming from the sample by a condensing optical
system;

controlling diffracted light of the condensed reflected light by a diffracted-light
control optical system; and

imaging by a detector a reflected light image from the sample to detect an
image signal, said reflected light image being obtained by the control; and

closing the shutter after the reflected light image has been imaged by the
detector.

16. (Currently Amended) A pattern defect inspection method comprising:
a recipe setting step for setting an inspection recipe and/or a review recipe;
a quantity-of-light calculating step for calculating a quantity of ultraviolet laser light in accordance with the inspection recipe and/or the review recipe that have been set by the recipe setting step;

an illumination step comprising the sub-steps of:

opening a shutter to allow passage of ultraviolet laser light emitted from a laser light source;

adjusting by a quantity-of-light adjusting unit the quantity of ultraviolet laser light emitted from a laser light source so as to become the quantity of light calculated by the quantity-of-light calculating step;

forming by illumination range forming unit an illumination range of the adjusted ultraviolet laser light in a sample;

reducing by coherence reducing system coherence of the ultraviolet laser light received within the formed illumination range; and

irradiating by an irradiation optical system the sample with the ultraviolet light flux whose coherence has been reduced; and

a detection step comprising the sub-steps of:

condensing reflected light coming from the sample by a condensing optical system;

controlling diffracted light of the condensed reflected light by a diffracted-light control optical system; and

imaging by a detector a reflected light image from the sample to detect an image signal, said reflected light image being obtained by the control; and

closing the shutter after the reflected light image has been imaged by the
detector.

17. (Original) A pattern defect inspection method according to claim 15, further comprising:

an image processing step for detecting a defect of a pattern formed on the sample on the basis of the detection image signal detected by the detector in an image processing unit.

18. (Original) A pattern defect inspection method according to claim 15, wherein, in the recipe setting step, the inspection recipe and/or the review recipe are set on a recipe setting screen.

19. (Currently Amended) A pattern defect inspection method according to claim 15, wherein the quantity of light is adjusted by use of ~~an optical element~~
capable of controlling said shutter to control the quantity of light so that the quantity of light is switched between a state close to ON and a state close to OFF.

20. (Currently Amended) A pattern defect inspection method comprising:
an illumination step for irradiating a sample with ultraviolet light flux; and
a step for obtaining an image signal by imaging the irradiated sample,
wherein:

said illumination step further comprises the sub-steps of:
opening a shutter to allow passage of ultraviolet laser light emitted from a
laser light source;

adjusting the quantity of ultraviolet laser light emitted from a laser light source
by quantity-of-light adjusting unit in accordance with a state of a sample;

forming by illumination range forming unit an illumination range of the
adjusted ultraviolet laser light in a sample;

reducing by coherence reducing system coherence of the ultraviolet laser
light received within the formed illumination range; and

irradiating by an irradiation optical system the sample with the ultraviolet light
flux whose coherence has been reduced; and

said step for obtaining an image signal further comprises the sub-steps of:

condensing reflected light coming from the sample by a condensing optical
system;

controlling diffracted light of the condensed reflected light by a diffracted-light
control optical system; and

imaging by a detector a reflected light image from the sample to detect an
image signal, said reflected light image being obtained by the control; and

closing the shutter after the reflected light image has been imaged by the
detector.

21. (Currently Amended) A pattern defect inspection method comprising:

opening a shutter to allow passage of ultraviolet laser light emitted from a laser
light source;

irradiating a wafer having a diameter of 300 mm with ultraviolet laser light
whose coherence has been reduced;

imaging the irradiated wafer to detect an image of the wafer; and

closing the shutter after the reflected light image has been imaged by the
detector; and

handling the detected image of the wafer to detect a defect having a size of 100 nm or less in a pattern formed on the wafer with a throughput of three pieces of wafers or more per hour.